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# TECHNICAL NEWS BULLETIN

OF THE

## BUREAU OF STANDARDS

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#### NEW RADIO FIELD STATIONS; MEASUREMENTS DURING ECLIPSE

Much of the research and experimental radio work of the bureau must be carried on at field stations located some distance from the main buildings of the bureau. This requirement is dictated by mutual interference caused by the radio experimental apparatus and by experimental apparatus in some of the bureau's laboratories. In order to overcome these difficulties, the bureau was given funds in 1931 to establish two permanent field stations. The necessary construction work has been completed, and the installation of radio equipment at the new field stations is about to begin.

The transmitting stations are located in three buildings on the United States experimental farm near Beltsville, Md. One building will contain a new transmitting set for sending standard frequency signals. This activity has been carried on for a number of years from temporary stations and is of great assistance to radio broadcasting stations in maintaining their assigned frequencies, and of value to manufacturers, testing laboratories, and Government departments in maintaining accurate frequency standards. The other two buildings will contain several transmitting sets for transmis-

sions of special signals to be received at the second field station.

The receiving station is located near Meadows, Md., southeast of Washington. Three small frame buildings will house receiving equipment for use in picking up the special transmissions from Beltsville. The studies carried on at these buildings will deal with transmission and reception characteristics of radio waves, such as fading, change of direction, and height of the Kennelly-Heaviside layer, which plays an important part in radio transmission, especially over long distances.

One of the transmitter buildings at Beltsville was made available to the bureau for use during the two weeks' period for transmissions during the solar eclipse of August 31. The transmissions were received and measurements made at a temporary receiving station near Kensington, Md. For such measurements to be of value, it was necessary that observations be made for a period of several days before the eclipse, during the eclipse, and continued for several days after the eclipse. Field intensity recorders showed no change in radio broadcast transmission during the eclipse. Ionization of the lower (100-kilometer) region of the Kennelly-Heaviside layer decreased considerably as the eclipse

progressed, but returned to normal after the eclipse. Changes were also noted in the region above 225 kilometers, but complete results are not yet available.

It is from experimental studies of radio phenomena that much of the knowledge of radio science has been gained. The bureau is now in a much better position to carry on these studies than ever before.

#### CHANGE IN SCHEDULE OF RADIO TRANSMISSIONS OF STANDARD FREQUENCY

The Bureau of Standards transmits standard frequencies from its station WWV, Washington, D. C., every Tuesday. The transmissions are on 5,000 kilocycles. Beginning October 1, the schedule will be changed. The transmissions will be given continuously from 10 a. m. to 12 noon, and from 8 to 10 p. m., eastern standard time. (From April to September, 1932, the schedule was from 2 to 4 p. m., and from 10 p. m. to midnight.)

The service may be used by transmitting stations in adjusting their transmitters to exact frequency, and by the public in calibrating frequency standards, and transmitting and receiving apparatus. The transmissions can be heard and utilized by stations equipped for continuous-wave reception throughout the United States, although not with certainty in some places. The accuracy of the frequency is at all times better than 1 cycle (1 in 5,000,000).

From the 5,000 kilocycles any frequency may be checked by the method of harmonics. Information on how to receive and utilize the signals is given in a pamphlet obtainable on request addressed to Bureau of Standards, Washington, D. C.

The transmissions consist mainly of continuous, unkeyed carrier frequency, giving a continuous whistle in the phones when received with an oscillatory receiving set. For the first five minutes there are transmitted the general call (CQ de WWV) and announcement of the frequency. The frequency and the call letters of the station (WWV) are given every 10 minutes thereafter.

Supplementary experimental transmissions are made at other times. Some of these are made with modulated waves, at various modulation frequencies. Information regarding proposed supplementary transmissions is given by radio during the regular

transmissions, and also announced in the newspapers.

The bureau desires to receive reports on the transmissions, especially because radio transmission phenomena change with the season of the year. The data desired are approximate field intensity, fading characteristics, and the suitability of the transmissions for frequency measurements. It is suggested that in reporting on intensities the following designations be used where field intensity measurement apparatus is not used: (1) Hardly perceptible, unreadable; (2) weak, readable now and then; (3) fairly good, readable with difficulty; (4) good, readable; and (5) very good, perfectly readable. A statement as to whether fading is present or not is desired, and if so, its characteristics, such as time between peaks of signal intensity. Statements as to type of receiving set and type of antenna used are also desired. The bureau would also appreciate reports on the use of the transmissions for purposes of frequency measurement or control.

All reports and letters regarding the transmissions should be addressed Bureau of Standards, Washington, D. C.

#### COMPARISON OF HIGH-VOLTAGE X-RAY GENERATORS

In medical X-ray practice many different types of high-tension generators, such as the mechanical rectifier, kenotron rectifier, or "constant potential," have come into general use. Since the voltage wave forms for these generators all differ, it is not possible by ordinary means to correlate their X-ray emission. Studies have been made in the past showing very large differences between such generators. In recent work at the bureau it was found that such factors as tube inclosure, tube characteristic, and aerial system have a very pronounced effect upon the generator rectification characteristics and hence upon the X-ray emission. These factors were apparently neglected in all earlier studies of this kind.

When controlling the X-ray generator by ordinary means (to give equal peak voltage and average tube current), mechanical rectifiers were found to differ in X-ray output by  $\pm 20$  per cent. The quality or penetration of the radiation was likewise found to vary over wide limits. Two mechanical rectifiers when giving equal outputs for a given filter were found to

give about equal qualities regardless of the peak voltage. A "constant-potential" generator operating at some voltage considerably lower than a mechanical rectifier was found, for any given filter and intensity, to have about the same quality as the mechanical rectifiers. Consequently, it is possible to relate directly the outputs of the three generators studied.

In the case of all of the rectifiers it was found that for equal effective (r. m. s.) voltages applied to the tube, the tube outputs for the same filtration were about equal both as regards quantity and quality. It is thus possible to reduce all radiations to terms of radiation excited by constant potential, which in itself is always characteristic of the voltage.

Accordingly, "constant-potential" radiations may be referred to as a base or a standard, in terms of which all other radiations may be expressed. Effective (r. m. s.) voltages are measured by means of a 150-megohm shielded resistor, which does not draw enough current from the generator to disturb its operation.

A more complete discussion of this work will be published as Research Paper No. 475 in the September number of the Bureau of Standards Journal of Research.

#### VOLUME CHANGES IN CERAMIC MATERIALS DUE TO WEATHERING

In order to obtain some definite knowledge regarding the effect of weathering on the volume of ceramic materials, representative samples of wall tile, terra cotta, and dinner ware were selected for observation. The study was begun three years ago, when some samples of each kind were subjected to the autoclave test at the Columbus branch of the bureau. A similar group of samples was exposed to actual weathering, while another group was subjected to a moisture-saturated atmosphere.

The measurements on the samples exposed to the weather and to the damp atmosphere to determine the percentage increase in length at the end of one year showed approximately the same results as had been obtained in the autoclave treatment, some cases exceeding it and some not reaching it. While the samples exposed to the damp atmosphere showed increases in length much the same as those exposed to the weather, in some cases the increase in length was slightly greater.

The measurements at the end of the second year showed the increase in

length in the samples exposed to the weather and in those in the damp atmosphere to be greater than in the autoclave treatment. One exception was noted in each series; however, not the same in the two cases.

The measurements at the end of the third year have just been completed. All of the samples showed a further increase in length. Those kept in a damp atmosphere showed a greater increase in length than those exposed to the weather, with two exceptions.

#### RESISTANCE OF VANADIUM STEEL DIES TO ABRASION BY A PLASTIC SPARK-PLUG PORCELAIN

Vanadium "tool-steel" dies have been in use by a manufacturer of spark plugs for extruding blanks from which the porcelain parts of the plugs are formed.

Abrasion tests were made on dies furnished by the spark-plug manufacturer in which the "standard" plastic abrasive material of 60 Maryland clay and 40 glass sand passing 20 mesh was used. These tests were followed by tests in which the plastic porcelain spark-plug composition (all passing 200 mesh) was used as the abrasive medium.

The results obtained with the "standard" abrasive are expressed by the equation  $25.31y^{0.55}=X$ , which represents the relation between abrasion loss  $y$  in  $\text{mm}^2$  and extrusion pressure  $X$  in  $\text{kg cm}^2$ .

The equation obtained with the porcelain material as the abrasive medium is  $159.0Z^{1.155}=X$ . At the same extrusion pressure the abrasive "influences" or "intensities" of the two abrasive materials can be compared. Under this condition,  $159.0Z^{1.155}=25.31y^{0.55}$  or  $Z=\frac{y^{0.55}}{4.926}$ .

At an extrusion pressure of 10  $\text{kg cm}^2$  the comparative abrasiveness of the two abrasive mediums expressed in terms of "abrasion loss" is  $Z:y=1:2.557$ , while at 50  $\text{kg cm}^2$  extrusion pressure the relation is as 1:8.005.

It appears, therefore, that abrasive loss increases at a more rapid rate as extrusion pressure increases for an abrasive of coarser grain than is the case for an abrasive of finer grain.

In the "standard" abrasive the effective abrasive material is quartz sand (hardness Moh's scale=7.0) passing a 20-mesh screen, whereas the effective abrasive material in the porcelain material is andalusite (hardness Moh's scale=7.5) passing 200 mesh in fineness.

# EDUCATIONAL COURSES AT THE BUREAU OF STANDARDS, 1932-33

Plans are now being formulated for a number of graduate study courses in physics, mathematics, and chemistry to be given at the bureau during the coming winter. Courses of this character have been given regularly for the past 24 years, and have been recognized by many of the leading universities in allowing credit for advanced degree. Although these courses are planned primarily for members of the staff of the Bureau of Standards, they are open on the same terms to any person who can furnish the instructor evidence of satisfactory preliminary training.

The educational committee has adopted the following two cycles as constituting the fundamental part of a graduate training in physics:

## Physics cycle:

Theoretical mechanics (due this year).

Electricity and magnetism.

Advanced optics.

## Mathematics cycle:

Theory of functions (due this year).

Differential equations.

Fourier series.

One course of each cycle is normally given each year. Following is the list of courses which will be given during the current year:

**Course A.**—Theoretical mechanics, Dr. P. R. Heyl. Sixty lectures given two hours per week throughout the year. Tentative time: Mondays and Wednesdays at 4.30 p. m. The first meeting of the class Monday, September 26. Requisites: A knowledge of differential and integral calculus. The course will include a study of the theory of the gyroscope and its application to the gyrocompass.

**Course B.**—Functions of a complex variable, Dr. W. E. Deming. Sixty lectures, Tuesdays and Thursdays at 8 a. m. Geometrical representation of complex numbers and fundamental theory. Rational functions, conformal representation, mapping, transformations; application to potential theory. Cauchy-Riemann differential equations; Laplace's equation; applications to problems in physics. Conjugate functions and applications to electricity and magnetism. Unicursal curves. Single and multiple valued functions. Line, surface, and volume integrals. Conservative and nonconservative forces. Stokes's, Green's, and Gauss's theorems, Cauchy's integral theorem.

Integration by residues. Fundamental theorem of algebra. Developments in series; Laurent's expansion, Fourier series. Distinctions between real and complex functions.

The following courses are offered tentatively, and they will not be finally approved by the committee unless such action is justified by the advance registration. Those interested in taking these courses are urged to register their intention promptly, as the committee this year is obliged to consider more carefully than usual whether or not a course is justified by the number planning to enroll.

**Course C.**—Thermodynamics, Dr. F. G. Brickwedde. Sixty lectures given two hours per week. Tentative time: Tuesdays and Thursdays at 4.30 p. m. Prerequisites: Differential and integral calculus, a previous elementary course in thermodynamics or heat, or a course in physical chemistry.

The subject thermodynamics will be treated as a branch of physics, and numerous applications to physical and engineering problems will be considered with the theory. To become familiar with the work of the bureau in the field of thermodynamics, special consideration will be given to applications made at the bureau, and where it can be arranged visits will be made to laboratories in order to become acquainted with the experimental methods and apparatus used in the measurement of thermal properties.

**Course D.**—Relativity and electromagnetic theory, Dr. C. Snow. Sixty lectures given two hours per week. Tentative time: Mondays and Wednesdays at 8 a. m. A second course on the mathematical theory of electricity for students who have done work equivalent to the Bureau of Standards course on electricity and magnetism.

**Course E.**—Ceramic petrography, Dr. H. Insley. Forty-five hours given two hours per week. Tentative time: Mondays and Wednesdays at 8 a. m. The first meeting of the course will be Monday, September 26. A laboratory course in the use of the petrographic microscope in the identifications of ceramic materials.

**Course F.**—Glass blowing, Dr. H. J. Wing. Thirty 1½-hour periods given twice a week and devoted to the fundamental operations of glass blowing. Tentative time: Tuesdays and Thursdays at 4.30 p. m.

**Course G.**—Advanced calculus, Dr. H. F. Schiefer. Sixty lectures given two hours per week. Tentative time: Tuesdays and Thursdays at 8 a. m.

**Prerequisite:** Calculus. This is an advanced course in differential and integral calculus with emphasis based on the fundamental theorems respecting existence of limits and the properties of continuous functions. Considerable time near the end of the course will be devoted to infinite series, algebraic transformations of series, and applications of uniform convergence.

**Tuition.**—The fee for each 60-lecture course and for course E will be \$25. For course F the fee will be \$20. Fees for courses continuing through the year are payable in two installments, if desired.

Unless otherwise specified, the first meetings will be held during the week beginning September 26.

Further information regarding the above courses may be obtained by addressing the educational committee, Bureau of Standards.

#### "SHORT-TIME" TESTS OF STEELS AT ELEVATED TEMPERATURES

Metallurgists and engineers in recent years have become thoroughly aware of the fact that much remains to be learned of the properties and behavior of metals at high temperatures. Modern power plants, petroleum refineries, chemical engineering plants, and many other present-day industries must rely in a large degree upon the dependable service of metals at relatively high temperatures.

The problem of the research and testing laboratory is to secure sufficiently dependable data on the strength of metals at high temperatures for the use of the designing engineer. This problem is by no means a simple one, very largely because the strength of metals at elevated temperatures involves a time factor; that is, a metal which appears to be sufficiently strong and rigid when tested to failure by rapid loading at some elevated temperature may fail at a much lower load if allowed to maintain this load over a longer period of time.

Nevertheless, rapid loading or short-time tests of metals at high temperatures are of value in securing a general idea of the relative behavior of metals of different composition at those temperatures.

Research Paper No. 474 in the September number of the Bureau of Standards Journal of Research reports the results of short-time tensile tests at high temperature for a medium manganese carbon steel, a series of cast nickel-chromium-iron alloys containing 35 per cent chromium and 10 to

45 per cent nickel, a series of tungsten-chromium-vanadium steels, and a series of molybdenum-chromium-vanadium steels.

#### CREEP IN STEELS UNDER LOAD AT HIGH TEMPERATURES

To-day the engineer refuses to resort to the old "cut-and-try" method of designing equipment required to operate at high pressures and high temperatures. He demands definite information regarding the behavior of commercial metals for such service. This demand applies to a variety of properties, but in particular, to the behavior of metals when subjected to fixed loads for long periods of time at elevated temperatures.

The measurement of the "flow" or "creep" of a metal at elevated temperatures for several hundred hours is the nearest approach to a satisfactory test by which materials may be judged for the usual service conditions. Long periods of time are required to obtain results by this method, which is in direct contrast to the "short-time" test. In the short-time test a tensile test specimen at an elevated temperature is broken in a relatively short period of time by the application of a steadily increasing load. This latter type of test affords preliminary information, with a great saving of time, in the study and development of metals for service at high temperatures.

In Research Paper No. 481, which will be published in the September number of the Bureau of Standards Journal of Research, results are given of long-time tension or "creep" tests at different temperatures on two tungsten-chromium-vanadium and a molybdenum-chromium-vanadium steel. These steels were tested as tempered after mechanical working (rolling) and are compared with steels of similar compositions which had been oil-quenched and tempered.

#### THEORY OF CHROMIUM PLATING

Chromium plating is now extensively applied on automobiles and household appliances. The solutions are simple and fairly cheap, but the electrical efficiency is low. The purpose of an investigation, recently completed at the bureau, was to develop a theory of the process, in the hope that improvements in it might thereby be promoted.

Although the plating baths consist principally of chromic acid, a small amount of sulphate is also necessary.

In this research it was shown that the beneficial effect of the sulphate is caused by the fact that it prevents the formation of an impervious film on the cathode and thus permits metal deposition. It was found possible to explain satisfactorily all the principal facts of chromium plating in terms of this theory and to make certain predictions which were experimentally confirmed. There is, however, no present prospect of any very large increase in the efficiency of this type of bath, but the above theory may aid in the development of other more efficient types.

The complete report of this work will be published as Research Paper No. 476 in the September number of the Bureau of Standards Journal of Research.

#### SOLDERS AND SOLDERING

In order to facilitate answering many inquiries on this subject, the bureau has just issued an 8-page mimeographed letter circular, LC343, *Solders and Soldering*.

Three classes of solders are described, viz, soft solders, hard solders (silver and brazing), and aluminum solders. The composition and properties of each are given, together with the methods of application and fluxes to be used, and a short bibliography follows.

Copies of this letter circular may be obtained upon request to the Bureau of Standards.

#### DETERMINATION OF STABILITY OF PAPER BY HEATING

The results of a study made at the bureau of some details involved in the technic of making the aging test for paper, in order to improve the reproducibility of the test results, were reported in *Paper Trade Journal*, July 28, 1932.

One of the most convenient methods so far devised for estimating the aging properties of paper consists of measuring the change in folding endurance after the paper has been heated in air for 72 hours at 100° C. and reconditioned. The per cent retention of folding endurance is taken as an index of the probable life of the paper. Four sources of error influencing the retention value are: (1) Lack of homogeneity in the structure of the paper, (2) variations in different folding machines, (3) variations in humidity during testing, and (4) variations in oven conditions.

Recommendations were made to minimize the effects of the above-mentioned variables. The paper used for the control sample should be as representative of the paper used for the heat treatment as possible. This is accomplished by cutting four folding strips adjacent to one another from 10 representative sheets and using alternate strips for control and heat test samples. It was found that the agreement of the folding endurance of adjacent strips was twice that of strips cut from widely separated areas.

In order to minimize the possibility of errors resulting from testing-machine variations and the slight unavoidable departures of the relative humidity from that specified for the testing room, the testing of control and heated strips is alternated so that both are tested on the different machines an equal number of times, and both are equally subjected to the effects of variable humidity.

Samples should be heated in an oven controlled at 100° C. plus or minus 2° C., in which the air is circulated to insure uniform temperature throughout.

With the procedure described the reproducibility of test data is commensurate with the accuracy of the folding test.

#### CAUSES OF MISREGISTER IN OFFSET PRINTING

The bureau is cooperating with the Lithographic Technical Foundation in a study of the offset lithographic process. The work was initiated at the request of the foundation because the industry suffers an annual loss estimated to be 25 per cent of the theoretical production resulting from a lack of knowledge of the characteristics of paper required for optimum results in printing on the modern high-speed offset press. Preliminary investigation, which included a survey of 31 commercial lithographic plants, revealed that the principal difficulty encountered, in which paper was involved, was misregister of prints. Hence the bureau's work has been confined to a study of the factors influencing the register of prints.

A series of experimental printings were made in a commercial lithographic plant under routine operating conditions to determine what factors influence the closeness of register, and further experimental printings were made to study the influence of the important factors on register. The plant selected was one in which constant atmospheric humidity is maintained,



thereby eliminating variability of results due to changing hygrometric state of the surrounding atmosphere. The papers printed were specially prepared by cooperating paper manufacturers, and the history of manufacture was supplemented by laboratory analyses to obtain complete knowledge of the characteristics of the papers for correlation with the results of the printing tests. The papers included samples of machine-finish litho of the same composition prepared with different degrees of hydration of fibers, and different fiber lengths, the same papers surface sized, coated papers of identical composition differing as to sizing in the uncoated paper, and extra strong machine-finish paper of like composition, differing as to degree of sizing. Information relative to the influence of paper characteristics was obtained in printing the various papers on one press with all other variables minimized, and printing representative samples on a press with controlled variations of such factors as pressure, water, and ink gave data on the effects of press variables.

The results indicate that paper characteristics are important in respect to obtaining register of prints. The papers that had received the least drastic mechanical treatment in manufacture gave most satisfactory results and papers that had received the most drastic treatment gave the poorest register, indicating the desirability of manufacturing offset papers with the least beating and jordaning essential for satisfactory strength and finish. Internal sizing was desirable, but the amount used, within normal limits, was not important. Other factors were important. A thorough conditioning of paper to equilibrium before printing the first color is essential and a reasonable seasoning period between printings is desirable. Plates should be standardized in respect to thickness, and register marks should be accurately placed. Increase in the amount of pressure used in printing tended to shorten the resultant prints slightly. The amount of water used did not appear important, as doubling the normal amount had no serious effect, but the extent of the area covered with ink was important in respect to register.

This work will be fully reported upon in Research Paper No. 480, to be published in the September number of the Bureau of Standards Journal of Research.

# NEW AND REVISED PUBLICATIONS ISSUED DURING AUGUST, 1932

## Journal of Research<sup>1</sup>

Bureau of Standards Journal of Research, vol. 9, No. 2, August, 1932 (RP Nos. 461 to 470, inclusive). Price, 25 cents. Obtainable by subscription.

## Research Papers<sup>1</sup>

- RP434. A contribution relative to the structure of collagen; J. Beek, jr. Price, 5 cents.
- RP448. International comparison of electrical standards; G. W. Vinal. Price, 5 cents.
- RP449. A method for the purification of rubber and properties of the purified rubber; A. T. McPherson. Price, 5 cents.
- RP450. Tests of a balanced thermocouple and filter radiometer as a standard ultra-violet dosage intensity meter; W. W. Coblenz, R. Stair, and J. M. Hogue. Price, 5 cents.
- RP451. The isoelectric point of wool; M. Harris. Price, 5 cents.

## Commercial Standards Monthly<sup>1</sup>

Commercial Standards Monthly, vol. 9, No. 2, August, 1932. Price, 10 cents. Obtainable by subscription.

## Technical News Bulletin<sup>1</sup>

Technical News Bulletin No. 184, August, 1932. Price, 5 cents. Obtainable by subscription.

## LETTER CIRCULARS<sup>2</sup>

- LC338. Detergents and certain detergent aids.
- LC339. Floor oils.

<sup>1</sup> Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year (United States and its possessions, Canada, Cuba, Mexico, Newfoundland, and Republic of Panama); other countries, 70 cents. Subscription to Journal of Research, \$2.50 per year; other countries, \$3.25. Subscription to Commercial Standards Monthly, \$1; other countries, \$1.60.

<sup>2</sup> "Letter circulars" are in mimeographed form and are designed primarily to answer specific inquiries. The supply is necessarily limited, so that, in general, but one copy can be sent in answer to each request. Copies are available only on application to the Bureau of Standards, Washington, D. C. No mailing list is maintained for letter circulars, and complete sets of back numbers can not be furnished.

- LC340. Sweeping compounds.  
 LC341. Drainpipe cleaners or solvents.  
 LC342. Testing of electrical instruments, meters, and instrument transformers. (Information for those desiring tests made by bureau.)  
 LC343. Solders and soldering.

#### OUTSIDE PUBLICATIONS \*

- Saeger, jr., C. M., and Ash, E. J., Volume changes of cast irons during casting; Transactions, American Foundrymen's Association (Chicago, Ill.), vol. 3, p. 172, August, 1932.
- Ash, E. J., and Saeger, jr., C. M., Shop method for determining volume changes in cast iron during casting; Transactions, American Foundrymen's Association (Chicago, Ill.), vol. 3, p. 188, August, 1932.
- Helson, H., and Judd, D. B., A study in photopic adaptation; Journal of Experimental Psychology (Lancaster, Pa.), vol. 15, p. 380, 1932.
- Gardner, I. C., The optical requirements of airplane mapping; British Journal of Photography (London, England), vol. 79, p. 459, 1932.
- Dickinson, H. C., and Allen, H. H., Conclusions from headlight research; Society of Automotive Engineers Journal (New York, N. Y.), vol. 31, p. 339, August, 1932.
- Brooks, D. B., and Garlock, E. A., The effect of humidity on engine power at altitude; National Advisory Committee for Aeronautics (Washington, D. C.), Technical Report No. 426, 1932. (Obtainable at 5 cents per copy from Superintendent of Documents.)
- Ingberg, S. H., Fire protection of valuable records; Proceedings, Fifth All-Ohio Safety Congress (Columbus, Ohio), p. 629, 1932.
- Ingberg, S. H., Fire exposure conditions for vaults and portable record containers; Proceedings, National Fire Protection Association (Boston, Mass.), vol. 36, p. 316, 1932.
- The following articles were published in the United States Daily (Washington, D. C.):
- Ely, E. W.:  
 Application to textiles of simplified practice, vol. 7, No. 133, p. 8, August 8, 1932.  
 Standardizing types of cotton products, vol. 7, No. 134, p. 8, August 9, 1932.
- Mertzke, A. J.:  
 Effects of housing conditions on business welfare, vol. 7, No. 143, p. 8, August 19, 1932.  
 Making over old dwellings as modern habitations, vol. 7, No. 144, p. 8, August 20, 1932.
- Taylor, J. S.:  
 Effect of public improvements on home building, vol. 7, No. 133, p. 8, August 8, 1932.  
 Inequality of property taxes as burden on homes, vol. 7, No. 141, p. 8, August 17, 1932.  
 Encouraging home ownership by easing tax burden, vol. 7, No. 142, p. 8, August 18, 1932.
- Worner, Ruby K.:  
 Testing warmth quality of textiles, vol. 7, No. 132, p. 8, August 6, 1932.  
 Theoretic and practical textile research, vol. 7, No. 135, p. 8, August 10, 1932.  
 Technological studies of textiles, vol. 7, No. 136, p. 8, August 11, 1932.  
 Cooperation in research with textile industry, vol. 7, No. 137, p. 8, August 12, 1932.
- Aid in standardization of textile products, vol. 7, No. 138, p. 8; August 13, 1932.

\* "Outside publications" are not for distribution or sale by the Government, unless otherwise noted. Requests should be sent direct to publishers.



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